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COMMUNICATION II

Effects of Foliar Applications of Selected Insecticides on Cocoa Pests and Pollinators

ABSTRAK

Pokok koko yang disembur dengan racun serangga iaitu Gamma HCH, methamidophos dan cypermethrin cara kabus setiap minggu selama 20 minggu berturutan menghasilkan bilangan kuntum bunga koko yang tinggi tetapi peratus pendebungaan efektif tidak berbeza dengan pokok koko tanpa semburan racun serangga. Racun-racun serangga ini juga memberi kesan yang berbeza keatas serangga. Populasi kepinding nyamuk, Helopeltis *sp, sangat rendah tetapi masih didapati turun naik serangga pendebunga* Forcipomyia *spp, afid,* Aphis *spp dan koya* Cataenococus *spp. Pemunculan serangga pendebunga* Forcipomyia *spp dalam perangkap tanah membuktikan bahawa penyemburan racun tidak menghalangkan pembiakan,* Forcipomyia *spp di ladang koko.*

ABSTRACT

Cocoa plants sprayed with insecticide such as Gamma HCH, methamidophos and cypermethrin using mistblowers at weekly intervals for 20 consecutive weeks produced high number of cocoa flowers but the percentage of effective pollination was not significantly different from the control. The effects of insecticides on the insects varied. The population of mosquitobug, Helopeltis *spp, was low but there was fluctuation with the midges,* Forcipomyia *spp. aphids,* Aphis *spp and mealy bugs,* Cataenococus *spp. The emergence of midges from the ground traps indicated that spraying of insecticides did not affect the breeding of the midges in the cocoa field.*

INTRODUCTION

In Malaysia, cocoa, *Theobroma cacoa* L, is the third most important agricultural export commodity after rubber and oil palm. It is expected that the total hectarage of cocoa will be > 200,000 ha with annual production being about 250,000 tons. Recent developments in the cocoa industry has enabled Malaysia to attain third ranking in world production. Several factors affect cocoa production including infestation by pests (insects, pathogens, rodents, weeds) and lack of pollinators.

The problems of pollination have been considered a limiting factor in cocoa production (Hernandez 1965). Most research on cocoa pollination focussed upon the study of midges as the principal pollinating agent (Chapman & Soria 1983; Azhar & Wahi 1984). Midges are universally accepted especially *Forcipomyia* spp, as the main pollinators of cocoa flowers (Soria 1970; Wirth 1981, Ibrahim & Hussein 1987). The role of stingless bees, *Trigona jati*, has been proven negative (Young 1985, Young *et al.* 1989).

The indiscriminate use of insecticides to control the major insect pests of cocoa especially cocoa pod borer, *Conopomorpha cramerella* (Lepidoptera: Gracillaridae), and mosquito bug, *Helopeltis* spp (Hemiptera : Miridae) influences the abundance of cocoa pollinators, *Forcipomyia* spp (Diptera : Ceratopogonidae). The objective of this investigation is to study the effect of foliar application of insecticides on cocoa pollinators and selected insect pests.

MATERIALS AND METHODS

A field trial was conducted in the cocoa farm of Universiti Pertanian Malaysia from 18 November 1988 to 4 April 1989. The insecticides used were Gamma HCH, methamidophos, cypermethrin and water as control. Thirty cocoa plants of pod bearing age were sprayed with the respective treatments at weekly intervals using a

portable mistblower. Each treatment plot was separated by two border rows of cocoa plants. A green nylon mesh was laid under the treated plant for collection of fallen flowers and pods. The rate of application for Gamma HCH, methamidophos and cypermethrin were 1.6 ml/1, 4.4 ml/1 and 1.6 ml/1, respectively. These were the rates recommended by the manufacturers to the cocoa growers in Malaysia. The insecticides were sprayed between 10.00h to 11.00h.

Ten cocoa plants from the respective treated plots were selected at random for enumeration of midges, *Forcipomyia* spp, mosquito bugs, *Helopeltis* spp, aphids, *Aphis* spp and mealybugs, *Cataenococus* spp. The number of midges resting on the flowers and pods on the selected trees were recorded. For the mosquito bugs, aphids and mealy bugs the number of adults were counted. These insects were monitored one day after chemical spraying between 1400 h and 1600 h at weekly intervals.

Thirty newly opened flowers were collected between 1400 h and 1600 h at weekly intervals. These flowers were dissected in the laboratory (27°C + 1.5) under a stereomicroscope for counting the number of pollens on the stigmas of the flowers. The data from the trials were analysed using F test and the means between treatments were separated by the Duncan Multiple Range Test.

RESULTS AND DISCUSSION

Table 1 shows that the total number of flowers were highest on cocoa plants sprayed with methamidophos. Although, there was significant difference ($P > 0.05$) between methamidophos treated plants and control, there were no significant differences between the different insecticide treated plants.

The high numbers of flowers from the insecticide treated plants could possibly be due to reduction of insect pests. The population of mosquito-bugs, *Helopeltis* spp. on methamidophos treated plants were found to be greatly reduced. On the other hand, a complex of insect pests such as the mosquite-bugs, aphids and mealy-bugs on control can adversely affect the growth of the growing plants and indirectly affect the number of flowers.

Although, methamidophos treated plants produced the highest number of flowers, spraying of this insecticide on cocoa foliage is not advisable because of its high toxicity to the operators. Hence, the use of less toxic pesticides such as synthetic pyrethroids i.e. cypermethrin would be more appropriate. In fact, synthetic pyrethroids have been used extensively against the major insect pests of cocoa (Sim 1986) with no adverse effects on cocoa pollinators (Jamaluddin 1990: Tan *et al.* 1987).

TABLE 1
Effects of selected insecticides on cocoa pollinators *Forcipomyia* spp. from 14.11.88 to 4.4.1989 at Universiti Pertanian Malaysia.

Treatment	Total No. of flowers/10 plts X ± S.E	% of Effective pollination X ± SE	*Forcipomyia* spp emergence/trap /week X ± SE
Gamma HCH	18597 ± 279.3 ab	16.2 ± 4.3 a	9.4 ± 2.2 a
Methamidophos	28584 ± 604.3 a	6.5 ± 1.3 a	169.9 ± 2.6 a
Cypermethrin	20383 ± 494.2 ab	9.5 ± 1.9 a	5.1 ± 1.4 a
Control	14167 ± 340.4 b	10.3 ± 0.9 a	6.1 ± 1.5 a

Mean followed by the same letters within column are not significantly different, at P = 0.5 by DRMT.

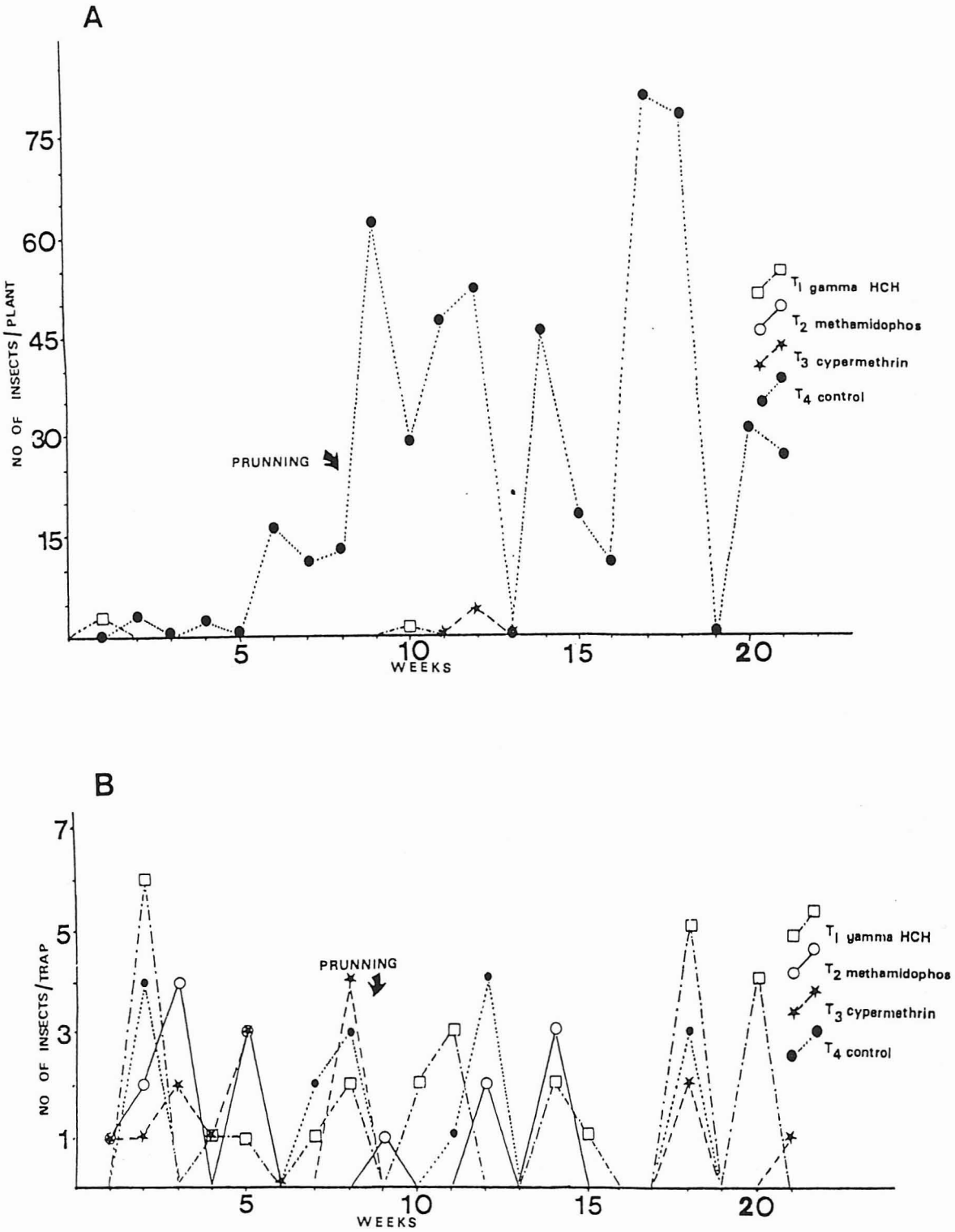

Fig. 1: The abundance of insects in cocoa farm at Universiti Pertanian Malaysia from 18.11.1988 to 4.4.1989 (A) Helopeltis *spp and (B)* Forcipomyia *spp.*

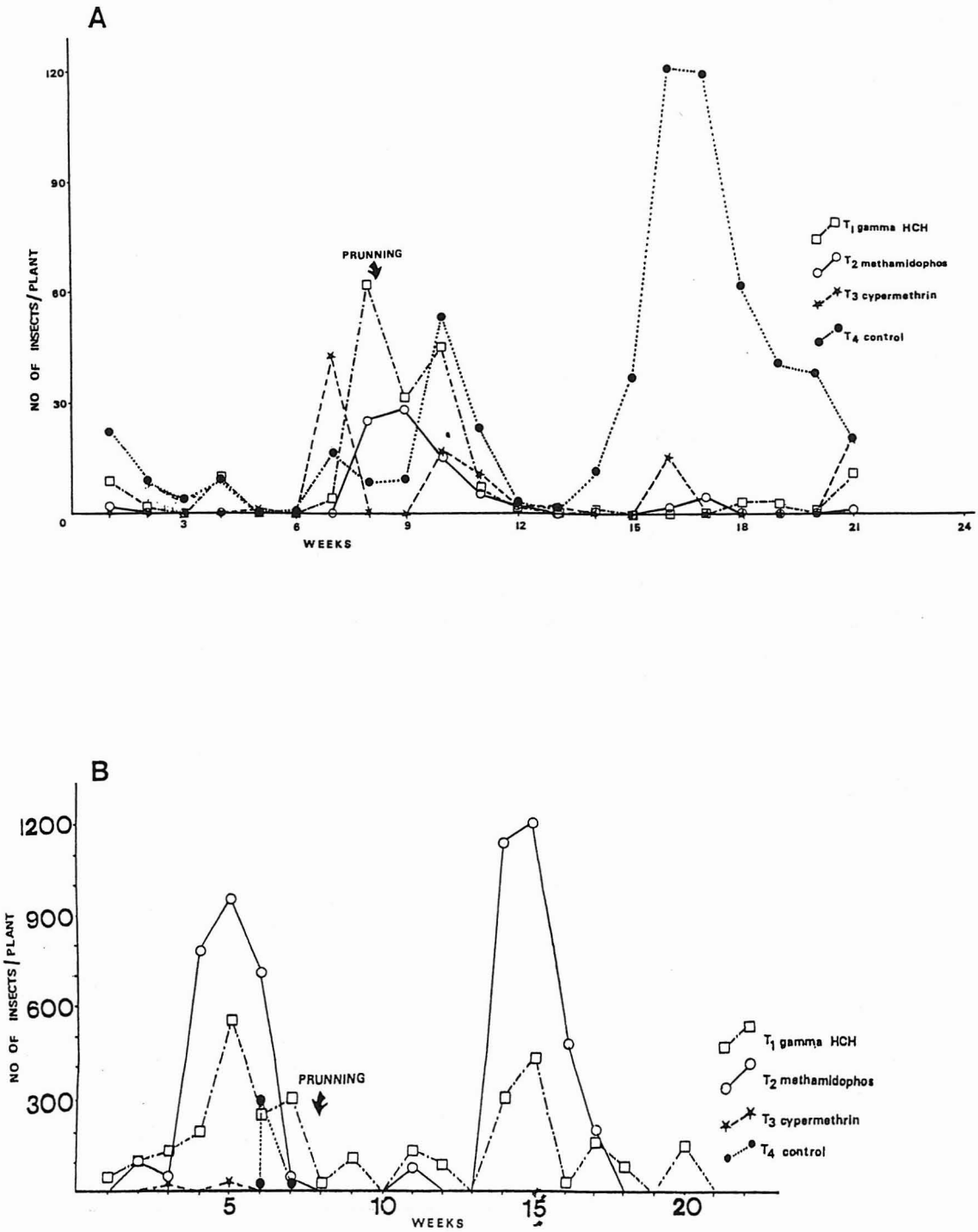

Fig. 2: Abundance of minor pests of cocoa farm at Universiti Pertanian Malaysia from 18.11.1988 to 4.4.1989
(A) mealybug, Cataenococus *spp.*
(B) Aphids *spp.*

It is generally accepted that > 35 pollens should be deposited on the stigma of a flower for effective pollination or fruit-set (Soria 1970). Those flowers with < 35 pollens on the stigma were found to abort. The percentage of effective pollination between those insecticide-sprayed plants and the control was not significantly different, suggesting that application of insecticides did not adversely affect the cocoa midges. This was also evidenced by the continuous emergence of midges from the ground traps. The number of midges emerging from the ground litters per week in the cocoa area sprayed with Gamma HCH, mathamidophos, cypermethrin and control plots were estimated to be 16,000/ha, 29,000/ha, 9,000/ha and 10,000/ha, respectively. The abundance of organic materials and succulent plants such as bananas provided diverse breeding habitat for the midges (Azhar and Ibrahim 1986).

Fig. 1A shows that Gamma HCH, mathamidophos and cypermethrin were effective in curbing the population of *Helopeltis* spp. The spraying of insecticides at weekly intervals reduced the population of the mosquito bugs. The nymphal stage of the *Helopeltis* alone takes 18 days giving little time for the built-up of the pest. The control had the highest built-up of *Helopeltis* sp. However, these insecticides failed to eliminate the *Forcipomyia* spp for these pollinators were continuously present in the field (*Fig. 1B*).

Monitoring of the population of minor insect pests, namely mealy-bug, *Cataenococus* spp and aphid, *Aphis* spp, showed that these insecticides failed to eliminate these pests. (*Fig. 2*). This could be attributed to the fast turn-over of the pests. It is generally known that generation interval of aphid and mealy-bugs is short and their fecundities high. Furthermore, the effects of pruning during the 8th week resulted in shoots which were suitable for the breeding of aphids and mealy -bugs.

CONCLUSION

The foliar application of insecticides, namely Gamma HCH, methamidophos and cypermethrin reduced the loss of cocoa flowers. These insecticides did not adversely affect the abundance of the midges and the minor pests such as aphids and mealy bugs.

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